10–12. Works of Robert Boyle, 1699; from J. H. Slack.

North American Medico-Chirurgical Review, 1858, Nos. 1 and 2.

50 copies of Dr. Hammond's Essay on the Alterations induced by Intermittent fever in the physical and chemical qualities of the Urine, and on the action of the Disulphate of Quinine.

Dr. James' Medical Dictionary, 3 vols., quarto; deposited by Dr. Hammond.

Also, a portrait of Prof. Ehrenberg, of Berlin, presented by Mr. James W. Queen.

The following were presented April 19th, 1858.

American Journal of Medical Sciences, Jan. and April, 1858.

Leeuwenhoekii Arcana Naturæ: Swammerdammii Historia Insectorum Generalis; from Mr. W. G. Tilghman, through Mr. Edward Tilghman.

The *papers* read before the Department during the present month, were as follows:

Observations on the Blood of the Sturgeon. By S. W. Mitchell, M.D. Referred to a Special Committee.

Summary of the Transactions of the Philadelphia Biological Society; by Henry Hartshorne, M. D., Recording Secretary. Referred to a special Committee.

Essay on the Supra-renal Capsules; by J. Darby, M. D. Referred to the Committee on Physiology.

A case of Fatty Degeneration of the Heart, in which death followed the inhalation of chloroform. By W. A. Hammond, M. D., U. S. A. Referred to the Committee on Pathology.

A *verbal communication* was made by J. Cheston Morris, M. D., April 5th, in connection with the exhibition of a human embryo, ten or twelve days old. A report of the *discussions* which have taken place in the Department during the month will be prepared and submitted hereafter.

HENRY HARTSHORNE, *Recorder.*

Observations on the Blood Crystals of the Sturgeon.

BY S. WEIR MITCHELL, M. D.

While studying the blood of the sturgeon some time ago, I observed certain facts of interest in regard to the crystallization of the albuminoid contents of the blood corpuscles. In man, it is difficult to obtain blood crystals, and in some cases I have totally failed to form them from his blood. In the sturgeon, the tendency on the part of the blood to undergo this change is so great that it is difficult to check the formation of crystals where their presence is undesirable. Two methods of procuring the crystals may be employed:

1st. A drop of fresh blood is placed on a slide, and allowed to evaporate to one half of its bulk. An equal quantity of distilled water is next added, and an over glass superimposed. The crystals sometimes appear in a few minutes, but more often they are first seen within periods varying from one hour to ten. Once begun, the process continues slowly for some time.

2d. A readier mode, where time is not an object, is to allow the whole mass of blood to stand in an open vessel exposed to light, and to a temperature of 60° or 70° F. Decomposition occurs slowly. The clot dissolves within a week, and the mass of blood becomes dark and very fluid. When evaporation is allowed to take place for a length of time, the blood becomes very offensive, and of a tar-like consistency.

At any time after forty-eight hours, a drop of this blood will yield by slight evaporation, without added water, the most beautiful crystals. After this period, the crystals form abundantly in the mass of blood, and may be easily examined.

The crystals formed in the two ways just described are essentially alike, but, as other crystals of a different character occur with them, it is necessary to describe all the forms which present themselves.

The first crystals which form, in whatever mode the blood be treated, are of

two kinds, neither of which are of albuminous nature. On plate 1, fig. 1, are drawn certain short abruptly acuminated crystals of a pyramidal form. These occur early, and are colorless, or nearly so. They strongly refract light, and are soluble in excess of ether, and in liq. potassæ, and insoluble in water. They disappear from the decomposing blood within two or three days after their formation. They are probably of a fatty character. We also observe in the blood very beautiful groups of long, shining, colorless needles, and slender, double pyramids. See pl. 7, fig. 2. These also appear before the true albuminoid crystals are seen; the addition of a little water readily dissolves them. They are undoubtedly of a saline character.

The 3rd set of crystals in order of formation are the true albuminoid crystals. These magnificent microscopic objects present themselves in the sturgeon blood either as hexagonal columns, or as sections of these, constituting hexagonal tablets of the utmost beauty, pl. 2, 3, and 7. Granting these crystals to be of albuminoid character, as Lehmann, Franke, and others have clearly made out there are some additional points of sufficient interest to deserve remark.

The mechanical behaviour of the crystals adds to the proofs of their animal character. Thus in place of being dissolved by certain re-agents, they become contracted and deformed, but lose no bulk. Again, if the cover glass be pressed down upon a large tetrahedron from the Guinea pig's blood, the crystal will sometimes break up, but occasionally one will yield to the pressure, and flatten out into a disc, resuming its angular form again when the pressure ceases. Here then are elastic crystals.

The persistency with which these delicate albuminoid bodies retain their form when left in the putrefying blood is very remarkable. Thus, on the third of July I placed some sturgeon blood in a vial. It soon presented an abundance of crystals which remained in it quite perfect up to the April following, when I threw it away. During this period the blood was utterly putrid, and developed foul gases to such an extent as to drive the cork out repeatedly.

This fact is the more singular, because almost every chemical re-agent acts on these crystals destructively, and because I have failed to preserve them as microscope specimens after very numerous efforts.

These columns and hexagons are, I believe, larger than any blood crystals hitherto studied. I have formed them of one-eighth to one-twelfth of an inch in length.

One chemist, Lehmann, is of opinion that the red coloring matter of the blood, which so adds to the beauty of these crystals, is an essential chemical constituent. Against this view it may be urged: first, that the color varies even in crystals of equal thickness; second, that I have often been able to bleach a crystal, or at least destroy or wash out its color with alcohol and water, without injury to its form. Third, that I have been able to re-dissolve the crystals in water and obtain them again by careful evaporation, devoid of color, but unchanged in crystalline type. My friend Prof. C. Johnston, of Baltimore, has obtained a like result with the blood crystals of the opossum.

The blood crystals of the sturgeon I have found to be the same in form, from whatever part of the body obtained. In the spring of 1854, I opened a young sturgeon, whose spleen was very large, and absolutely stuffed with blood crystals, whose form was the same as that of the crystals obtained by artificial means. Very frequent examinations of the blood crystals of man have afforded me like results for him, and have shown how permanent is the type of crystalline form in his case. The blood of the male, the female, the fœtus and placenta; and the blood of many diseases, as dysentery, measles, cholera, typhoid fever, yellow fever, pneumonia, etc., gave in every case the same form of blood crystal.

Prof. Johnston, of Baltimore, informs me as a contrast to this statement, that the splenic vein blood of the opossum affords tetrahedral forms, whilst all the other blood of this animal yields rhombic crystals.

The reactions afforded by the blood crystals of the sturgeon are difficult to follow, since many agents completely disintegrate or fibrillate them, without

acting as solvents. Others, as liq. soda and liq. potassæ dissolve them readily, and at the same time so affect their coloring matter as to give rise to a succession of tints, usually resulting in some shade of green.

Hot water acts readily as a solvent; cold water, in excess, has a like effect after some hours.

Hydrochloric and sulphuric acids dissolve the crystals easily. Nitrate of silver merely blackens them. Alcohol contracts, swells, and at last granulates them.

In good glycerine, the crystals lose color, but remain intact as to form for many days, so that it may be possible to use this agent as a means of preparing them for the microscopic cabinet.

Otho Franke, who has made numerous researches upon blood crystals, first observed the occurrence of crystals *within* the envelope of the human blood corpuscle. I have frequently seen examples of this phenomenon in the large corpuscles of the sturgeon. The crystals are as usual hexagonal plates, capable of being re-dissolved, so as to give back to view the original outline of the corpuscle. In some instances the nucleus is seen through the crystal, or along side of it, but I am not sure that it is caught or included within the crystal itself, pl. 6.

The last fact to which I desire to call attention, is, I think, quite novel, and certainly very interesting, as illustrative of some points in pathology. When a glass slide containing a group of the crystals is kept for some weeks, the crystals slowly dry, crack in many directions, and by degrees alter in color so as to exhibit very beautiful tints, such as yellow, orange, purple, and varied shades of green.

The same phenomenon may also be seen in the nebulous masses of pigment, in dried blood which has not crystallized. It is to be presumed that these changes of color are due to the slow oxidising influence of the atmosphere. They recal very strikingly the alterations of tint undergone by the leaf in Autumn, and are best comprehended by a glance at the illustrations which accompany this paper. Pl. 2, 3, 4, 5.

March, 1858.

Summary of the Transactions of the Philadelphia Biological Society.

Reported by HENRY HARTSHORNE, M. D., Recording Secretary.

Jan. 18th, 1858. Dr. WM. A. HAMMOND read a paper "*On the Injection of Urea and other substances into the blood;*"* giving an account of several series of experiments instituted in order to determine the correctness of Frerich's explanation of uræmic intoxication, by the conversion of urea into carbonate of ammonia, and resulting, among other conclusions, in the opinion, that this theory fails to be sustained, and that the carbonate of ammonia is not, itself, more poisonous than urea.

In the brief discussion which ensued, the fact, mentioned in the paper, of the non-appearance of ammonia in the breath after the injection into the blood of urea mixed with vesical mucus, was noted, as being contrary to expectation based on other facts. Dr. HAMMOND explained that, in his view, the conversion of urea into carbonate of ammonia, which occurs in the presence of mucus out of the body, will not take place in living blood.

Dr. S. W. MITCHELL remarked that *healthy* mucus has not been found to hasten this decomposition of urea; but that, out of the body, urea will, without any ferment, undergo spontaneous conversion.

Reduction of temperature by depletion.—Dr. S. W. MITCHELL mentioned that, having occasion, recently, in a case of insanity, to take from a patient a very large amount of blood—189 fluid ounces—in a short space of time, he observed

* See N. Amer. Medico-Chirg. Review, March, 1858.